(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 October 2002 (31.10.2002)

PCT

(10) International Publication Number
WO 02/085130 A1

(51) International Patent Classification[7]: A23G 9/02, 9/04

(21) International Application Number: PCT/US02/11846

(22) International Filing Date: 19 April 2002 (19.04.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/838,809 20 April 2001 (20.04.2001) US

(71) Applicant: **THE COCA-COLA COMPANY** [US/US]; One Coca-Cola Plaza, Atlanta, GA 30313 (US).

(72) Inventors: **DUBOIS, Grant, E.**; 215 Quincy Lane, Roswell, GA 30076 (US). **SHEPHERD, James, M.**; 1723 Regency Park Walk, Atlanta, GA 30341 (US). **RYAN, Sandra, C.**; 3845 Princeton Oaks, Kennesaw, GA 30144 (US).

(74) Agents: **BIRCH, ANTHONY, L.**; FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P., 1300 I Street, NW, Washington, DC 20005-3315 et al. (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 02/085130 A1

(54) Title: REDUCED CALORIE OR NON-CALORIC FROZEN CARBONATED BEVERAGE

(57) Abstract: The present invention is a non-caloric or reduced calorie frozen carbonated beverage and a method of making it. The freezing point of a diet beverage syrup is reduced through the use of a freezing point depressant, particularly a Sugar MNS which is used to replace a portion of the known high-potency non-caloric sweetener. The preferred Sugar MNS for use in the beverage and method of the present invention is erythritol.

NON CALORIC FROZEN CARBONATED BEVERAGE

Field of the Invention

[001] The present invention relates to a method of making reduced calorie and non-caloric frozen carbonated and non-carbonated beverages through the use of freezing point depressants, particularly Sugar MacroNutrient Substitutes (MNSs) for example, erythritol, for depressing the freezing point of the beverage. More particularly, the present invention relates to non-caloric frozen carbonated beverages made by the disclosed method.

Background of the Invention

[002] Full calorie frozen carbonated beverages (FCBs) are known in the art and have been produced for years. FCBs are produced via devices that freeze a mixture of ingredients including syrup, water and carbon dioxide in a mixing chamber. The mixture freezes on the inner surface of the mixing chamber, which is surrounded by a helical coil through which a refrigerant passes. A rotating shaft is disposed inside the chamber which has a plurality of outwardly projecting blades that scrape the mixture off the inside wall of the mixing chamber. Once the carbonated beverage is in the desired frozen state, the product is dispensed from the chamber through a product valve.

[003] The temperature and viscosity of the ingredients within the mixing chamber are maintained by a control system that controls the refrigeration system. Product quality is controlled through the balance of ingredients as well as pressures and temperatures within the chamber. The chemical properties of FCBs also play an important part in the normal functioning of FCB dispensing devices and the quality of the FCB products.

[004] Current FCB products are limited to full calorie FCBs. Caloric products contain common sugars, such as sucrose or high fructose corn syrup (HFCS), which are used as sweeteners at concentrations of ca. 10% (w/v). These sugars play an important part in the freezing point depression of FCBs. Under normal operating conditions of FCB machines, the addition of caloric sweeteners depresses the freezing point of the product making them dispensable in a slush-like state. By contrast, a diet beverage, or non-caloric syrup contains no common sugars such as sucrose or HFCS, and thus lacks

a freezing point depressant. Without a modified freezing point, diet syrup would freeze into blocks of ice in FCB machines rather than attaining the slush-like property found in caloric FCBs and necessary for proper dispensing.

[005] Freezing point is a colligative property and the freezing point of a solution depends on the number of solute molecules present, not on the nature of the solute. Non-caloric ingredients, such as salts or acids, could be added to diet syrup to provide freezing point depression, thus allowing slush to be obtained. However, these ingredients result in a salty or sour product affecting the taste and quality of the beverage. A proposed alternative to the addition of acids or salts would be to increase the amount of non-caloric sweeteners e.g., aspartame, saccharin, or a mixture of these to cause freezing point depression. However, due to the potency of these sweeteners, the taste and quality of the resulting diet FCBs will again be unacceptably altered.

[006] The present invention overcomes the problems associated with the production of diet FCBs through the use of freezing point modifiers. Freezing point modifiers include 1) one or more Sugar MNSs alone or in combination with salts and/or acids, and 2) one or more sugars or sugar alcohols in combination with one or more salts, acids and/or Sugar MNSs. In both cases, the freezing point modifier will usually be used in combination with a high-potency non-caloric sweetener or mixture of such sweeteners. Reduced calorie and diet FCBs according to the present invention can achieve the necessary slushy state without unacceptable alterations of the taste and quality of the diet syrup.

[007] Sugar MNSs have been used as low calorie sweeteners in a variety of food products. A sugar MNS is a non-caloric or reduced calorie polyhydric alcohol with molecular weight ranging from ca. 100-1000.

[008] U.S. Patent No. 4,810,516, by Knog-Chan et. al. discloses the use of polyols in the production of reduced calorie chocolate confections. Knog-Chan et al. substitute a nondigestible polyol fatty acid polyester for the natural fat. Knog-Chan et al. also disclose the use of an artificial sweetener plus a partially or wholly nondigestible carbohydrate bulking agent as substitutable for sugar.

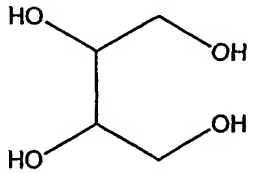
[009] European Patent Application No. 236,288 to Bernhardtdiscloses edible, wholly or partially nondigestible intermediate melting polyol fatty acid polyesters having certain rheological properties (e.g., viscosity, liquid/solid stability) at body temperatures. These intermediate melting polyol polyesters are disclosed as partial or total fat replacements in food products, including ice cream and other fat-containing frozen desserts.

[010] U.S. Patent No. 6,010,734, to Whelan et. al, discloses a low calorie frozen dessert product, which comprises from about 2 to about 20% fat of which about 30 to 100% is edible, wholly or partially nondigestible polyol fatty acid polyesters.

[011] Based on the above, it is clear that polyol polyesters have only been used in the area of frozen food products as fat substitutes. These polyols reduce the caloric content of the food product by fat substitution.

[012] Known sugar MNSs for use as low calorie sweeteners include erythritol, maltitol, lactitol, isomalt, fructooligosaccharide sweeteners and xylitol. Again, these Sugar MNSs are used to reduce the caloric content of food, but in this instance, they replace sugar and other sweeteners. The following examples describe the known manner in which Sugar MNSs have generally been used.

[013] Erythritol is a known sweetener for use in the production of reduced calorie food products.



ERYTHRITOL

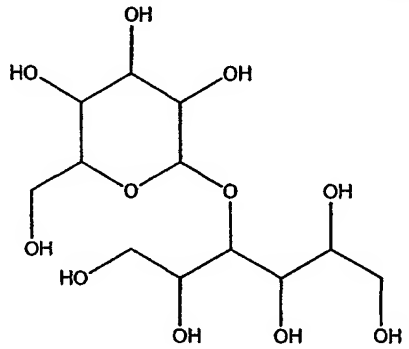
[014] U.S. Patent No. 5,273,771, to Rapaille et al. discloses a composition suitable for use as the sweetener in a reduced calorie food product. The sweetener includes 5 to 50% by weight erythritol, 30 to 80% by weight sorbitol and 5 to 25% by weight glucose oligomer of DE 10 to 30.

[015] U.S. Patent No. 5,973,212, to De Sadeleer et al. discloses a method for producing spraying dried erythritol. This free-flowing erythritol

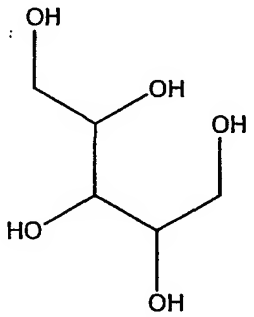
powder is disclosed for use as a sweetener preferably in combination with a synthetic sweetener such as aspartame.

[016] U.S. Patent No. 6,045,850, to Kondou discloses a low-calorie compounded cocoa composition including cocoa powder, erythritol, and a sweetener.

[017] Maltitol and xylitol are other Sugar MNSs that are commonly used in reduced calorie food products to replace full calorie sweeteners.



MALTITOL



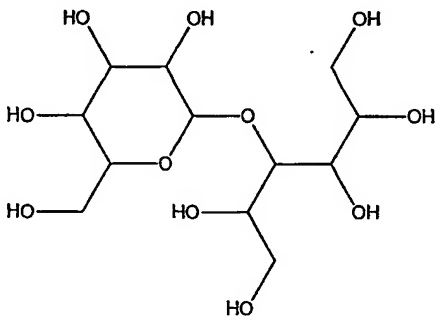
XYLITOL

[018] U.S. Patent Nos. 6,083,527 and 6,071,500 to Thistle disclose a candy-like confection which minimizes tooth decay. The confection preferably includes xylitol as the natural sweetener and calcium hydroxide which increases the pH level of the saliva in the mouth to reduce the presence of bacteria.

[019] U.S. Patent No. 5,017,400 to Olinger et al. discloses compositions containing a combination of xylitol and maltitol, which is claimed to provide a synergistic sweetening effect.

[020] U.S. Patent No. 5,700,514, to Gonze et al. discloses a process for producing a lozenge which includes a sweetener of, for example, erythritol or maltitol, and a binding agent.

[021] The final Sugar MNS that has been noted for general use as a sugar substitute is lactitol.



LACTITOL

[022] U.S. Patent Nos. 5,516,763 and 5,672,589 to Heikkila et al. disclose crystalline lactitol monohydrate as a bulk sweetener for the total or partial replacement of sucrose, in dietetic products, confectionery, bakery products, cereals, desserts, jams, beverages, chocolate, chewing gum and ice-cream. In Heikkila et al., lactitol is disclosed as a fat replacement system in frozen products.

[023] U.S. Patent No. 5,527,554 to Olinger et al. discloses an improved frozen dessert made without sucrose or corn syrup solids. The frozen dessert is sweetened by lactitol and hydrogenated starch hydrolysates.

[024] The present invention overcomes the deficiencies associated with the production of reduced calorie and diet FCBs through the use of freezing point depressants including sugars in combination with non-caloric sweeteners, Sugar MNSs, salts, acids and mixtures thereof, particularly erythritol, to produce reduced calorie frozen carbonated beverages. While Sugar MNSs have been used as reduced calorie alternative sweeteners in a variety of food products, including frozen dessert products, Sugar MNSs have never been considered for their freezing point depression in the production of frozen beverages.

Summary of the Invention

[025] It has been discovered that freezing point depressants, including sugars in combination with non-caloric sweeteners, Sugar MNSs, salts, acids and mixtures thereof enable the preparation of reduced calorie and non-caloric FCBs without adversely affecting product taste and quality. The present invention is a reduced calorie or non-caloric frozen carbonated beverage that remains slushy and dispensable. According to one aspect of the present invention there is disclosed a method for depressing the freezing point of diet beverage syrup by adding a freezing point depressant for use in the production of frozen carbonated beverages.

[026] There is further disclosed, a reduced calorie or non-caloric frozen carbonated beverage including a Sugar MNS containing beverage syrup, carbon dioxide and water.

[027] There is still further disclosed, a reduced calorie or non-caloric frozen non-carbonated beverage produced from a beverage syrup including a freezing point depressant.

[028] Finally, there is disclosed a method of making a reduced calorie or non-caloric frozen carbonated beverage by adding a freezing point depressant containing beverage syrup to a chamber with water and carbon dioxide to produce a reduced calorie frozen carbonated beverage.

[029] Additional objects and advantages of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

[030] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

Detailed Description of the Invention

[031] The present invention relates to the product of reduced calorie and non-caloric frozen beverage products and a method of producing them. The beverages according to the present invention may be carbonated or non-

carbonated. Preferred beverages according to the present invention are carbonated.

[032] In the known process for producing FCBs which is described, for example in U.S. Patent No. 5,806,550 which is incorporated herein by reference in its entirety, water, beverage syrup and carbon dioxide are fed to a chamber within which the FCB will be produced. The terms "frozen carbonated dispenser" and "dispenser" are synonymous with an apparatus capable of dispensing a slushy product. Any currently known or after developed method for making FCB can be used with the present invention which relates to the use of freezing point depressants in the beverage syrup which reduces the calories of the beverage while depressing the freezing point of the syrup. As used in the present invention "reduced calorie" refers to a beverage that has 50% or less of the calories that would be associated with a full calorie equivalent beverage. A "substantially reduced calorie" beverage is one that has a 75% reduction in calories. A "non-caloric" FCB is one having a 100% or near 100% reduction in calories. The present invention results in a reduced calorie or non-caloric frozen carbonated beverage which remains slushy and dispensable.

[033] The present invention involves utilizing various freezing point depressants including sugars, sugar alcohols, Sugar MNSs, salts and acids, along with high-potency non-caloric sweeteners to allow freezing point depression of reduced calorie or non-caloric frozen beverages and achieving a slush-like consistency.

[034] Beverage syrups for use according to the present invention use a freezing point depressant alone or in combination with a high-potency non-caloric sweetener, such as aspartame or saccharin. The term "non-caloric sweetener" refers to sweeteners which provide human bioavailable calorie contents of zero or nearly zero to food or beverage products.

[035] Freezing point depressants for use according to the present invention include sugars when used in combination with non-caloric sweeteners. Preferred sugars for use according to the present invention include sucrose, high fructose corn syrup, glucose, fructose and lactose. When full calorie sugars are used as freezing point depressants, the resulting reduced calorie frozen carbonated beverage will achieve at least a 50%

calorie reduction but due to the full calorie nature of the sugar will only be able to achieve a relative calorie reduction.

[036] If a FCB is desired having more significantly reduced calories, then alternative freezing point depressants will have to used. Other freezing point depressants for use according to the present invention include, propylene glycol, glycerol, and sorbitol. According to one embodiment of the present invention, glycerol is used as the freezing point depressant. While glycerol is a full calorie sweetener, it achieves sufficient freezing point depression at sufficiently low levels to result in a beverage having substantial calorie reductions.

[037] Other reduced calorie FCBs can be prepared using Sugar MNSs. Sugar MNSs for use according to the present invention include any art recognized FDA approved compositions that provide the necessary freezing point depression when used in a reduced calorie beverage syrup.

[038] As used in the present application, the term "Sugar MNS" refers to a polyhydric alcohol containing at least 3, preferably from 3 to 17 hydroxyl groups. Sugar MNSs include sugars (i.e., monosaccharides, disaccharides, and trisaccharides), sugar alcohols, other sugar derivatives (i.e., alkyl glycosides), polyglycerols such as diglycerol and triglycerol, pentaerythritol, sugar ethers such as sorbitan and polyvinyl alcohols. Non-limiting examples of sugars, sugar alcohols and sugar derivatives include xylose, arabinose, ribose, xylitol, glycerol, erythritol, glucose, methyl glucoside, mannose, galactose, fructose, sorbitol, maltose, lactose, sucrose, raffinose, tagatose, and maltotriose. Preferred Sugar MNSs for use in the present invention include erythritol, isomalt, maltitol, lactitol and fructo-oligosaccharide sweetener. Sugar MNSs can be used to prepare reduced calorie, substantially reduced calorie and non-caloric FCBs.

[039] Sugar MNSs can be used in amounts that have been approved for use in food products. Preferably, erythritol is added in an amount of up to the current FDA approved limit of 3.5% (w/v).

[040] Preferred Sugar MNSs for use in the present invention do not have a laxative effect when used in diet beverage syrup. The most preferred Sugar MNS for use in the present invention is erythritol since it exhibits essentially no laxative effect. Erythritol when consumed at moderate levels,

e.g., in a FCB, is completely absorbed into the bloodstream from the small intestine and then is quantitatively excreted in the urine unchanged. Other Sugar MNSs such as isomalt, malitol and lactitol are less preferred since they are not absorbed from the small intestine and they enter the large intestine where they are fermented by anaerobic bacteria to produce short chain fatty acids and gases. Short chain fatty acids have high water binding activity providing possible effects such as soft stools and diarrhea.

[041] The diet beverage syrup according to the present invention including a freezing point depressant, e.g., a Sugar MNS, has sufficient freezing point depression to provide a dispensable reduced calorie FCB. The product is dispensed in a "slushy" condition. As used herein, the terms "slushy", "slush", "slushy-like", and "slush-like" are synonymous. These terms refer to the physical properties of beverages where the beverages are not in a solid frozen state and the viscosity of the beverages is higher than its liquid state at room temperature.

[042] The FCBs according to the present invention can be modified with appropriate salts or acids to a level which does not interfere with the taste and quality of the resultant beverage. Appropriate salts include, but are not limited to, sodium chloride, potassium chloride, sodium gluconate or potassium gluconate. Other appropriate salts will be readily apparent to the skilled artisan. Preferred salts are those such as sodium gluconate or potassium gluconate which have less taste and therefore result in freezing point depression with less effect on the taste of the FCB.

[043] FCBs according to the present invention can include any additives that would be acceptable in such beverages. Such additives may include for example preservatives. Appropriate additives and amounts would be readily apparent to the skilled artisan.

[044] The formulation of the present invention provides beverages wherein the caloric content is reduced by 50% based on a full calorie equivalent FCB. Substantially reduced calorie beverages can be produced having a calorie content reduced by 75% and non-caloric beverages can be produced preferably having below 2 calories per 8 ounce serving.

Examples

[045] The following examples illustrate the characteristics and properties of the invention. However, these examples do not limit the invention. The invention is limited only by the claims appended to this specification.

Example 1: Sample calculation of amount of Freezing Point Depressant

[046] Freezing Point Depression for water is

$$\Delta T = KFM$$

where ΔT is the change in freezing point temperature in degrees Celsius, K_F is the molal freezing point depression constant and is 1.855 for water and m is the molal concentration of solute in water. Now, if one takes a sucrose-sweetened beverage formulation and, for purpose of simplicity assumes that all ingredients are held constant in concentration except for the sweetener concentration, then the molal concentration of the new reduced calorie sweetener system (e.g., erythritol and aspartame) must equal the molal concentration of sucrose in the original formulation. Since the molecular weight of sucrose is 342 and if the sucrose concentration in the original beverage was 10% (w/v), then the original beverage contained approximately 0.3 m of sucrose. To achieve the same freezing point depression, the erythritol and aspartame must have a total concentration of 0.3 m. Since aspartame will be present at only about 0.001 m, erythritol must be present at about 0.299 m. Since aspartame plays such a negligible role in freezing point depression, it is a reasonable approximation that all of the freezing point depression comes from erythritol. Thus, to get the same freezing point depression as 10% sucrose, i.e., 0.3 m sucrose, one must use 0.3 m erythritol. The molecular weight of erythritol is 122, thus requiring 36.6. grams of erythritol per 1000 g of water, approximately 3.5% (w/v). The resulting FCB would be non-caloric.

[047] Alternatively, a reduced calorie FCB can be produced by replacing the 10% sucrose with 5% sucrose and 1.75% erythritol to achieve a product with a 50% reduction in calories.

Example 2

[048] A reduced calorie beverage syrup according to the present invention was produced by combining 3.5% w/v of erythritol into cola flavored syrup and then reducing the level the of high-potency non-caloric sweetener e.g., aspartame or saccharin by 1/3. This formulation resulted in syrup that's freezing point was depressed thereby achieving the production of a slushy-like product inside the frozen carbonated drink dispenser.

Example 3

[049] A diet cola frozen carbonated beverage was prepared from a cola syrup containing freezing point depressant according to the present invention. 0.43% cola flavoring was combined with 0.02% of a preservative and 3.45 to about 3.55% of a sweetener system. The sweetener system contained between 3.41 and 3.49% erythritol, 0.02 to 0.05% aspartame and 0.005 to 0.008 saccharin.

Example 4

[050] A diet cherry frozen carbonated beverage was prepared from a cherry syrup containing freezing point depressant according to the present invention. 0.19% cherry flavoring was combined with 0.02% of a preservative and 3.45 to about 3.55% of a sweetener system. The sweetener system contained between 3.41 and 3.49% erythritol, 0.02 to 0.05% aspartame and 0.005 to 0.008 saccharin.

[051] Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.

We claim:

1. A reduced calorie or non-caloric frozen carbonated beverage comprising:

(a) a reduced calorie or non-caloric beverage syrup containing a freezing point depressant;

(b) water; and

(c) carbon dioxide.

2. The frozen carbonated beverage of claim 1, wherein the beverage is a reduced calorie beverage having a given freezing point and comprising:

(a) a reduced calorie beverage syrup containing a mixture of a non-caloric sweetener and a low caloric sugar, the low caloric sugar acting as a freezing point depressant, as compared to freezing point depressant characteristics of the non-caloric sweetener;

(b) water; and

(c) carbon dioxide.

3. The beverage of claim 2, wherein a ratio of low caloric sugar to non-caloric sweetener in the mixture is selected to achieve said given freezing point.

4. The beverage of claim 3, wherein the given freezing point is determined from a reference molal concentration of high-caloric sugar in a standard frozen carbonated beverage for achieving said given freezing point, and the amount of low-caloric sugar in the mixture is selected to achieve substantially the same molal concentration thereof as the reference molal concentration.

5. A reduced calorie or non-caloric frozen non-carbonated beverage comprising:

(a) a beverage syrup containing a high-potency non-caloric sweetener and a freezing point depressant; and

(b) water.

6. The frozen non-carbonated beverage of claim 5, wherein the beverage is a reduced calorie beverage having a given freezing point and comprising:

(a) a beverage syrup containing a mixture of non-caloric sweetener and a low caloric sugar, said low-caloric sugar acting as a freezing point depressant, as compared to freezing point depressant characteristics of the non-caloric sweetener; and

(b) water.

7. The beverage of claim 6, wherein a ratio of low-caloric sugar to non-caloric sweetener in the mixture is selected to achieve said given freezing point.

8. The beverage of claim 7, wherein the given freezing point is determined from a reference molal concentration of high-caloric sugar in a standard frozen carbonated beverage for achieving said given freezing point, and the amount of low-caloric sugar in the mixture is selected to achieve substantially the same molal concentration thereof as the reference molal concentration.

9. The beverage according to claims 1-8, wherein the freezing point depressant comprises a Sugar MNS selected from a group consisting of erythritol, isomalt, maltitol, lactitol, or fructo-oligosaccharide sweetener.

10. The beverage according to claims 1 and 9, wherein the Sugar MNS is erythritol.

11. The beverage according to claims 1, 5, 9, and 10 wherein the non-caloric sweetener is selected from at least one of aspartame, saccharin, acesulfame-K, cyclamate, or sucralose.

12. The beverage according to claims 1, 2 5, and 6, wherein the freezing point depressant comprises a sugar MNS selected from at least one of propylene glycol, glycerol, and sorbitol.

13. The beverage according to claim 12, wherein the freezing point depressant comprises a sugar MNS selected from at least two of propylene glycol, glycerol, and sorbitol.

14. The beverage according to claim 12, wherein the freezing point depressant comprises a sugar MNS including propylene glycol, glycerol, and sorbitol.

15. The beverage according to claims 12-14, wherein the beverage syrup contains a high-potency non-caloric sweetener selected from at least one of aspartame, saccharin, acesulfame-K, cyclamate, and sucralose.

16. The beverage according to claim 15, wherein the high-potency non-caloric sweetener includes sucralose.

17. A method of depressing the freezing point of a reduced calorie beverage syrup comprising:

preparing a reduced calorie beverage syrup by replacing up to one third of a high-potency non-caloric sweetener with a freezing point depressant selected from a Sugar MNS selected from at least one of erythritol, isomalt, maltitol, lactitol, or fructo-oligosaccharide sweetener.

18. A method of making a reduced calorie frozen carbonated beverage comprising:

combining a reduced calorie or non-caloric beverage syrup containing a freezing point depressant at a reduced temperature with water; and carbon dioxide.

19. The method of making a frozen carbonated beverage of claim 18, wherein the beverage is a reduced calorie beverage having a given freezing point and comprising:

combining a reduce calorie beverage syrup containing a mixture of a non-caloric sweetener and a low caloric sugar, said low caloric sugar acting as a freezing point depressant, as compared to freezing point depressant characteristics of the non-caloric sweetener; water and carbon dioxide.

20. The method of claim 19, wherein a ratio of low caloric sugar to non-caloric sweetener in the mixture is selected to achieve said given freezing point.

21. The method of claim 20, wherein the given freezing point is determined from a reference molal concentration of high-caloric sugar in a standard frozen carbonated beverage for achieving said freezing point, and the amount of low-caloric sugar in the mixture is selected to achieve substantially the same molal concentration thereof as the reference molal concentration.

22. A method of controlling the freezing point depressant characteristics of a beverage syrup to be mixed with a diluent comprising the steps of:

(a) blending a non-caloric sweetener and a low-caloric sugar, said low-caloric sugar acting as a freezing point depressant for the diluent compared to freezing point depressant characteristics of the non-caloric sweetener; and

(b) controlling the ratio of low-caloric sugar to non-caloric sweetener to achieve a given freezing point of the diluent and syrup mixture.

23. The method of claim 22, wherein the given freezing point is determined from a reference molal concentration of high-caloric sugar in a standard frozen carbonated beverage for achieving said given freezing point, and the amount of low-caloric sugar in the mixture is selected to achieve substantially the same molal concentration thereof as the reference molal concentration.

24. The method of claim 22, wherein said ratio is up to 1/3.

25. The method of claims 17-24, wherein the freezing point depressant comprises a Sugar MNS selected from at least one of erythritol, isomalt, maltitol, lactitol, or fructo-oligosaccharide sweetener.

26. The method according to claim 25, wherein the freezing point depressant is erythritol.

27. The method of claim 25, wherein the beverage syrup contains a high-potency non-caloric sweetener selected from at least one of aspartame, saccharin, acesulfame-K, cyclamate, or sucralose.

28. A method of depressing the freezing point of a reduced calorie beverage syrup comprising:

preparing a reduced caloric beverage syrup by replacing up to one third of a high-potency non-caloric sweetener with a freezing point depressant selected from at least one of propylene glycol, glycerol and sorbitol.

29. The method according to claims 17-19 and 22 wherein the freezing point depressant comprises a sugar MNS selected from at least one of propylene glycol, glycerol, and sorbitol.

30. The beverage according to claims 28 and 29, wherein the freezing point depressant comprises a sugar MNS selected from at least two of propylene glycol, glycerol, and sorbitol.

31. The beverage according to claim 30, wherein the freezing point depressant comprises a sugar MNS including propylene glycol, glycerol, and sorbitol.

32. The beverage according to claims 29-31, wherein the beverage syrup contains a high-potency non-caloric sweetener selected from at least one of aspartame, saccharin, acesulfame-K, cyclamate, and sucralose.

33. The method according to claim 28 and 32, wherein the high-potency non-caloric sweetener include sucralose.

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/US 02/11846

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A23G9/02 A23G9/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A23G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 626 441 A (WOLKSTEIN MELVIN) 2 December 1986 (1986-12-02) column 1, line 6-13; claims 1-11,13,15,16,18-25 column 3, line 53-55; examples 1-15	1-33
X	EP 0 941 668 A (NIKKEN CHEMICALS CO LTD) 15 September 1999 (1999-09-15) paragraphs '0034!-'0042!,'0060!-'0067!,'0106!-'0122!; claims 3-10,12-31; examples 23,24	1-33
X	US 5 853 785 A (NAYYAR DALIP K ET AL) 29 December 1998 (1998-12-29) column 2, line 10-67; claims 1-10; example 5 column 3, line 24-34 column 4, line 6-16	1-33

-/—

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 July 2002	07/08/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Heirbaut, M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/US 02/11846

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 585 480 A (VOGEL MANFRED ET AL) 17 December 1996 (1996-12-17) column 2, line 45-49; claims 1-4,7; examples 6,7	5-17, 22-33
X	WO 99 30578 A (NUTRASWEET CO) 24 June 1999 (1999-06-24) claims 5-8,18,19,23-25,33,38-41,71; examples 1-5	5-17, 22-33
X	US 6 010 734 A (WHELAN RICHARD HOWARD ET AL) 4 January 2000 (2000-01-04) column 5, line 62 -column 6, line 8; claim 8 column 11, line 46 -column 12, line 25	5-17, 22-33
X	EP 0 236 288 A (PROCTER & GAMBLE) 9 September 1987 (1987-09-09) page 15, line 1-19 page 9, line 23-30 page 14, line 3-12	5-17, 22-33
X	US 5 527 554 A (OLINGER PHILIP M ET AL) 18 June 1996 (1996-06-18) column 6, line 53-56; claims 1-3,5,8,9,14; examples 1-3 column 3, line 41-46	5-17, 22-33
X	US 3 826 829 A (MARULICH A) 30 July 1974 (1974-07-30) column 3, line 52-63; claims 1-3; example 1	1
P,X	US 2002/001656 A1 (BRANDER RITA W ET AL) 3 January 2002 (2002-01-03) paragraphs '0007!,'0017!,'0021!-'0024!; claims 1-3,9-11; example 1	1-33
E	EP 1 210 880 A (SAN EI GEN FFI INC) 5 June 2002 (2002-06-05) paragraphs '0040!,'0048!-'0052!,'0062!,'0081!,'0089!, '0102!,'0111!,'0121!,'0130!; claim 1	5-17, 22-33
A	US 5 973 212 A (DE SADELEER JOS WILLY GHISLAIN ET AL) 26 October 1999 (1999-10-26) the whole document	1-33
A	EP 0 511 761 A (CERESTAR HOLDING BV) 4 November 1992 (1992-11-04) the whole document	1-33

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/US 02/11846

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4626441 A	02-12-1986	AT 79725 T	15-09-1992
		AU 3507584 A	23-04-1985
		DE 3485899 D1	01-10-1992
		DE 3485899 T2	02-10-1996
		EP 0157873 A1	16-10-1985
		WO 8501421 A1	11-04-1985
EP 0941668 A	15-09-1999	JP 10117763 A	12-05-1998
		JP 10117693 A	12-05-1998
		JP 10117694 A	12-05-1998
		EP 0941668 A1	15-09-1999
		WO 9816120 A1	23-04-1998
US 5853785 A	29-12-1998	CA 2186938 A1	19-04-1997
		CN 1157113 A	20-08-1997
		EP 0772977 A2	14-05-1997
US 5585480 A	17-12-1996	DE 4341780 A1	14-06-1995
		AT 195225 T	15-08-2000
		DE 59409473 D1	14-09-2000
		DK 657106 T3	04-12-2000
		EP 0657106 A1	14-06-1995
		JP 7250645 A	03-10-1995
WO 9930578 A	24-06-1999	AU 1936499 A	05-07-1999
		WO 9930578 A1	24-06-1999
US 6010734 A	04-01-2000	US 5084295 A	28-01-1992
		AT 132700 T	15-01-1996
		AU 669090 B2	23-05-1996
		AU 1657395 A	29-06-1995
		AU 660275 B2	22-06-1995
		AU 7254691 A	21-08-1991
		CA 2073774 A1	03-08-1991
		DE 69116344 D1	22-02-1996
		DE 69116344 T2	11-07-1996
		DK 513187 T3	10-06-1996
		EP 0513187 A1	19-11-1992
		ES 2082195 T3	16-03-1996
		FI 910510 A ,B,	03-08-1991
		GR 3018638 T3	30-04-1996
		IE 910359 A1	14-08-1991
		JP 5503426 T	10-06-1993
		JP 3095772 B2	10-10-2000
		KR 203644 B1	15-06-1999
		PT 96642 A ,B	31-10-1991
		TR 25253 A	01-01-1993
		WO 9111109 A1	08-08-1991
EP 0236288 A	09-09-1987	AT 401325 B	26-08-1996
		AT 41687 A	15-01-1996
		EP 0236288 A2	09-09-1987
		AU 609712 B2	09-05-1991
		AU 6954587 A	01-09-1988
		DE 3788443 D1	27-01-1994
		DE 3788443 T2	28-04-1994
		FI 870839 A ,B,	27-08-1988
		HK 1006132 A1	12-02-1999

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/US 02/11846

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0236288 A		JP 2703225 B2	26-01-1998
		JP 63230798 A	27-09-1988
		US 2001003119 A1	07-06-2001
US 5527554 A	18-06-1996	AU 5823196 A	18-12-1996
		CA 2222638 A1	05-12-1996
		EP 0828435 A1	18-03-1998
		WO 9638050 A1	05-12-1996
		JP 11505727 T	25-05-1999
		NO 975456 A	17-12-1997
US 3826829 A	30-07-1974	AU 451608 B	15-08-1974
		AU 3514271 A	03-05-1973
		CA 950745 A1	09-07-1974
US 2002001656 A1	03-01-2002	CA 2309503 A1	02-12-2000
EP 1210880 A	05-06-2002	JP 2000125807 A	09-05-2000
		JP 2000135058 A	16-05-2000
		JP 2000135062 A	16-05-2000
		JP 2000135055 A	16-05-2000
		JP 2000135049 A	16-05-2000
		JP 2000135066 A	16-05-2000
		JP 2000152757 A	06-06-2000
		JP 2000152764 A	06-06-2000
		JP 2000157193 A	13-06-2000
		JP 2000157184 A	13-06-2000
		JP 2000166462 A	20-06-2000
		JP 2000175631 A	27-06-2000
		JP 2000175668 A	27-06-2000
		JP 2000175647 A	27-06-2000
		JP 2000175630 A	27-06-2000
		JP 2000169876 A	20-06-2000
		JP 2000175648 A	27-06-2000
		JP 2000175649 A	27-06-2000
		AU 6366399 A	15-05-2000
		EP 1210880 A1	05-06-2002
		WO 0024273 A1	04-05-2000
		JP 2000197462 A	18-07-2000
		JP 2000197463 A	18-07-2000
		AU 6365999 A	15-05-2000
		JP 2000279104 A	10-10-2000
US 5973212 A	26-10-1999	AT 127663 T	15-09-1995
		DE 69204701 D1	19-10-1995
		DE 69204701 T2	22-02-1996
		DK 497439 T3	13-11-1995
		EP 0497439 A1	05-08-1992
		ES 2077348 T3	16-11-1995
		JP 3145759 B2	12-03-2001
		JP 4335870 A	24-11-1992
EP 0511761 A	04-11-1992	AT 131004 T	15-12-1995
		DE 69206470 D1	18-01-1996
		DE 69206470 T2	25-04-1996
		DK 511761 T3	08-01-1996
		EP 0511761 A1	04-11-1992
		ES 2080443 T3	01-02-1996

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int onal Application No
PCT/US 02/11846

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0511761 A		JP 3222538 B2	29-10-2001
		JP 6054660 A	01-03-1994
		US 5273771 A	28-12-1993